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Article (Accepted Version)

Pike, Alison and Oliver, Bonamy R (2017) Child behavior and sibling relationship quality: a cross-lagged analysis. *Journal of Family Psychology*, 31 (2). pp. 250-255. ISSN 0893-3200

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Child Behavior and Sibling Relationship Quality: A Cross-Lagged Analysis

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Abstract

Bidirectional associations between sibling relationships and children's problem behaviors are robust, and links with prosocial behavior have also been reported. Using cross-lagged models, we were able to conservatively test temporal directions of links between positive and negative aspects of sibling relationships and children's prosocial behavior and conduct problems across a three-year time-span in middle childhood. The Avon Longitudinal Study of Parents and Children (ALSPAC: <http://www.bristol.ac.uk/alspac/researchers/data-access/data-dictionary/>) is an ongoing population-based study designed to investigate the effects of a wide range of factors on children's health and development. For the purposes of the current analyses, we included 2043 ALSPAC families who had just one older sibling as well as the target child, with an age-gap of no more than five years. Mothers reported about the quality of the sibling relationship and both children's prosocial behavior and conduct problems when the target child was aged 4, and again at age 7 years. Confirming our hypothesis, individual child behavior was predictive of sibling relationship quality, and sibling relationship quality was predictive of later child behavior, providing robust evidence of bidirectionality for both prosocial behavior and conduct problems. It would be consistent to expect that an improvement in *either* sibling relationship quality *or* individual children's behavior could have a positive spillover effect. We also found evidence of older sibling dominance in the domain of prosocial behavior and the positive aspects of sibling interaction.

Keywords: ALSPAC, siblings, prosocial behavior, cross-lagged, conduct problems

Child Behavior and Sibling Relationship Quality: A Cross-Lagged Analysis

Among personal relationships, those between siblings are distinct. First, they are emotionally uninhibited, potentially increasing siblings' influence on one another (Dunn, 2002). Second, siblings spend a great deal of time together -- by middle childhood, the time spent with siblings commonly outstrips that spent with parents (McHale, Kim, Whiteman, & Crouter, 2007).

Associations between sibling relationships and children's conduct problems are well-documented (Buist, Dekovic, & Prinzie, 2013), and links with prosocial behavior (e.g., Pike, Coldwell, & Dunn, 2005) and social competence have also been reported (Buist & Vermande, 2014). Such links have been demonstrated longitudinally as well as cross-sectionally, the interpretation of which tends to conceptualize sibling relationship quality as influencing child behavior (e.g., Milevsky, 2011). This interpretation bias has resulted in studies that only test associations in the direction of relationship quality predicting child behavior, most notably longitudinal studies that test associations of sibling relationship quality at an earlier time-point, with child behavior at a later time-point. For example, Garcia and colleagues (2000) reported significant prediction from sibling conflict at age 5 to aggression at age 6, and Buist and colleagues (2014) demonstrated that sibling conflict was related to higher levels of externalizing problems that then (surprisingly) decreased more swiftly.

There are very few examples of child behavior being used to predict subsequent sibling relationship quality. However, Kramer and Kowal (2005) found that children's behavior towards a friend in the preschool years predicted the quality of sibling interaction in adolescence. In addition, Stocker, Burwell and Briggs (2002) showed that sibling conflict in middle childhood predicted symptoms of anxiety, depression, and delinquency two years later, and the reverse was not true – child adjustment at the first

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time-point did not predict sibling relationship quality two years later.

Using cross-lagged methodology enables the examination of the relative prediction of individual child behavior to sibling relationship quality over time and vice-versa, while accounting for stability and cross-sectional associations. Testing the temporal pattern of associations between sibling relationship quality and child behavior in this way can inform whether sibling relationships influence child behavior, or whether they are merely a reflection of the individual children's behavioral profiles.

Current Study

For the first time, we used a large, population-based sampling frame to examine longitudinal links between positive and negative aspects of sibling relationships and children's prosocial behavior and conduct problems. The focus was sibling pairs in early to middle childhood – the children ranged from 4 to 12 years. A key feature of the current study was our ability to assess birth order. Would the older siblings maintain their dominance, as is seen in younger children (Dunn, Creps, & Brown, 1996), or is the behavior of younger siblings also important, as would be expected if a more egalitarian relationship has been established by this stage (Buhrmester & Furman, 1990)? We focus on conduct problems because these are the best predictor of diverse mental health problems in adulthood (Kim-Cohen et al., 2003), and prosocial behavior (not merely the absence of antisocial behavior), which predicts long-term education, employment, and criminal outcomes (Jones, Greenberg, & Crowley, 2015). We hypothesized that the temporal flow of influence would be bidirectional.

Method

Sample and Procedure

The Avon Longitudinal Study of Parents and Children (ALSPAC: <http://www.bristol.ac.uk/alspac/researchers/data-access/data-dictionary/>) is an

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ongoing population-based study designed to investigate the effects of a wide range of factors on children's health and development. All women resident in Avon, UK with expected dates of delivery between April 1, 1991 and December 31, 1992 were contacted and eligible for participation (a total of 20,248 eligible pregnancies). Of these, 14,541 (71.8%) women enrolled in ALSPAC during pregnancy in 1990-1992, resulting in 14,062 live-born children, and 13,988 children alive at 12 months of age. Compared with the 1991 U.K. National Census Data, the ALSPAC sample was similar to the population as a whole, except for showing a higher proportion of married/cohabiting mothers, and families who were owner-occupiers, and, consistent with the area where the study is based, a smaller proportion of mothers from ethnic minorities (4.1% versus 7.6%). For further detail about the ALSPAC sample, please see Boyd et al., 2013; Copeland, Shanahan, Costello, & Angold, 2009; Dunn et al., 2011. Ethical approval for the study was obtained from the ALSPAC Law and Ethics Committee and the local Research Ethics Committees.

By age 4, questionnaires were sent to 12,349 mothers, and were returned by 9,501 (76.9%). At age 7, questionnaires were sent out to 10,662 mothers, of whom 8,505 (79.8%) completed the assessment. In order to control as many extraneous family factors as possible, we elected to include the 2573 ALSPAC families who had just one older sibling in addition to the target child. We were restricted to the use of older -- rather than younger -- siblings because of availability of data. Of these families, we excluded a further 530 families with an age gap of more than 5 years, to avoid sibling dynamics that were either disengaged or more akin to a caretaker relationship (Dunn, 2002). The final sample consisted of approximately equal numbers of the four sibling sex-constellations in 2043 families. The age gap between siblings was between 1 and 5 years (mean = 2.37 years).

Measures

All measures were collected via postal questionnaire when the younger sibling was four (Time 1) and seven (Time 2) years of age. Cronbach's alphas reported here are for the current sibling sample.

Child Adjustment. Maternal reports of younger and older sibling conduct problems and prosocial behavior were collected using the Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997). The SDQ is a widely used screening instrument with reliability and validity demonstrated in a large national sample (Goodman, 2001). Mothers are asked to indicate how true different statements of behaviors are about their child within the last six months, using a three-point scale ranging from "not true" (0) through "sometimes true" (1) to "certainly true" (2). There are five subscales, two of which were used in the current study: prosocial behavior (5 items e.g., "considerate of other people's feelings"; $\alpha = .70-.75$), and conduct problems (5 items: e.g., "often fights with other children or bullies them"; $\alpha = .49-.58$). The low alphas for conduct problems reflect the small number of items measuring a range of different problems (e.g., "often lies or cheats" does not have the aggressive element of the fighting/bullying item). These alphas are in line with previous reports (e.g., Goodman, 2001, Lewis & Plomin, 2015), and the scale demonstrates good test-retest reliability, and clinical validity (Goodman, 1999).

Sibling Dyad. The sibling relationship was measured at each time point using the same 16 items that assess a variety of positive and negative aspects of the dyadic relationship. These items were derived from a maternal interview about sibling relationship (Stocker, Dunn, & Plomin, 1989), which demonstrates good agreement with subsequent child reports about the relationship (Dunn, Slomkowski, Beardsall, & Rende, 1994), and with observations of sibling interaction (Dunn, Stocker, & Plomin,

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1990). Mothers were asked to indicate how frequently younger siblings felt or behaved in ways towards the older sibling, and the older sibling towards the younger; responses were 'frequently' (scored 2), 'sometimes' (1) or 'rarely or never' (0). Factor analysis indicated two factors that we classify here as 'positivity' and 'negativity' in the dyadic relationship. 'Positivity' included eight items (four for younger sibling about older sibling, four for older sibling about younger sibling) 'likes to be with', 'wants to play with', 'has fun with' and 'misses when away' (Cronbach's $\alpha = .80-.87$); 'Negativity' included eight items (four for each sibling), 'quarrels with', 'jealous when mother is with', 'jealous when father is with', and 'teases' ($\alpha = .83-.84$).

Statistical Analysis

Before addressing our hypothesis, we conducted tests of measurement invariance using MPlus v 6.1.1, running unconstrained and constrained models for prosocial behaviour and sibling positivity and for conduct problems and sibling negativity. For the unconstrained models, items for a given scale (e.g., SDQ prosocial behavior, sibling positivity) were considered to be loaded onto latent factors, with loadings free to vary across time point (Time 1 and Time 2) and for younger and older siblings where applicable. For constrained models, loadings were constrained to be equal across both time points, and for younger and older siblings. Model fit comparisons from the unconstrained and constrained models were then compared. Measurement invariance was verified for all measures with no significant change to model fit revealed. Details are available from the first author.

We hypothesized that the temporal flow of influence between sibling relationship quality and child behavior would be bidirectional. To test this hypothesis, cross-lagged models were used. Models were estimated using MPlus v 6.1.1, with missing data accounted for using Full Information Maximum Likelihood, and were

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designed to explore the longitudinal relationships between younger and older sibling behavior and dyadic sibling relationships. These models were used to examine the extent to which reciprocal associations were evident between a) prosocial behavior and positivity in the sibling dyad and b) conduct problems and negativity in the dyad. Bias-corrected bootstrapped 95% confidence intervals (95% CIs) based on 10000 samples were used to assess potential differences in the magnitude between similar paths.

Results

Preliminary Analysis

Our first analysis involved creating residual scores of our variables of interest, controlling for the number of boys in the sibling dyad (0, 1, or 2), the age of the older sibling at Time 1 (younger sibling age was constant), and maternal education. In combination, these variables accounted for up to 4.0% of the variance for sibling relationship quality, and up to 2.3% of the variance for behavior. Standardized, residual scores were used for all further analysis. Correlations for study variables are shown in Table 1. All correlations were in the expected direction, significant at $p < .001$, and were small ($r = -.08$, for older sibling conduct problems with younger sibling prosocial behavior) to large ($r = .59$, for dyad negativity across time) in magnitude.

Cross-Lagged Models

Models fit satisfactorily for both prosocial behavior ($\chi^2(12) = 1534.34, p < .001$; RMSEA = 0.00 (90% C.I. = 0.00-0.00); CFI = 1.00; TLI = 1.00) and for conduct problems ($\chi^2(12) = 1720.33, p < .001$; RMSEA = 0.00 (90% C.I. = 0.00-0.00); CFI = 1.00; TLI = 1.00). The results of these cross-lagged models are shown in Figures 1 and 2.

Prosocial Behavior and Sibling Dyad Positivity. Within-time associations between younger and older sibling prosocial behavior and sibling dyad positivity are represented by double-headed arrows in Figure 1. Moderate positive associations were

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evident at Time 1, indicating links between prosocial behavior of younger and older siblings, as well as with positivity in the sibling relationship. According to 95% CIs, associations between positivity and younger and older sibling prosocial behavior were significantly smaller in magnitude at T2 than at T1, though still significant and in the expected direction. Autoregressive pathways in Figure 1 (that is, relationships within domain across Time 1 and Time 2), suggested considerable stability in prosocial behavior over the three years for both younger and older siblings, and for positivity in the sibling dyad. Of primary focus here are the longitudinal cross-construct connections given by the cross-lagged paths, which indicate the extent to which younger and older siblings' prosocial behavior, and the positivity in the sibling dyad influence one another over time, while accounting for within-construct stability. These cross-lagged path coefficients indicated some bidirectionality between siblings' prosocial behavior and positivity in the sibling dyad. That is, positivity in the sibling dyad at Time 1 was associated with both younger and older sibling prosocial behavior at Time 2, and similarly, older sibling prosocial behavior at Time 1 was significantly associated with both younger sibling prosocial behavior and sibling dyad positivity at Time 2, even accounting for these constructs at Time 1. Strikingly, younger sibling prosocial behavior at Time 1 did not relate to either older sibling prosocial behavior or to positivity in the sibling dyad at Time 2; 95%CIs indicated that these pathways differed significantly from the equivalent older sibling pathways.

Conduct Problems and Sibling Dyad Negativity. Turning to the results for conduct problems and dyad negativity (see Figure 2), bidirectionality is again seen between child behavior and sibling relationships. For example, within time associations show a very similar pattern to those for dyad positivity and prosocial behavior. Furthermore, the cross-lagged paths from both older sibling conduct problems and dyad negativity at

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Time 1, to all three outcomes at Time 2, are also very similar to those seen for prosocial behavior and sibling dyad positivity. However, cross-lagged paths from younger sibling conduct problems show a different pattern from those seen for prosocial behavior.

Notably, for conduct problems and sibling dyad negativity, 95% CIs indicate that associations do not differ significantly for younger and older siblings.

Discussion

Using a large, population-based sample of sibling pairs in middle childhood, we replicated previously demonstrated moderate associations between sibling relationship quality and both prosocial behavior and conduct problems. Some evidence of specificity was revealed, in that sibling relationship positivity was more highly correlated with prosocial behavior, whereas negativity was more associated with conduct problems. Thus, we conducted cross-lagged models on these specific associations. We uncovered evidence of reciprocity, as well as older sibling dominance.

Reciprocity

Confirming our hypothesis, individual child behavior was predictive of sibling relationship quality, and sibling relationship quality was predictive of later child behavior, providing robust evidence of bidirectionality for both prosocial behavior and conduct problems. In the case of prosocial behavior, these findings add weight to the idea that siblings can act as resources for one another. Specifically, those brothers and sisters who spend time playing together in a friendly and helpful manner may develop skills such as sharing, cooperation, and empathy—prosocial behaviors exhibited across time and context (Pike et al., 2005), and that may spill over into other social arenas. It is equally true, however, that children who enjoy prosocial interactions with peers may transfer these behaviors to the family environment; past research has shown that

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children can become nicer siblings “with a little help from their friends” (Kramer & Gottman, 1992, p. 685).

In the case of conduct problems, we confirm here that sibling conflict is not harmless; children experiencing high levels of sibling negativity are at much greater risk of behavior problems (Buist et al., 2013). Moreover, our longitudinal findings support the idea that escalating cycles of sibling conflict may effectively ‘teach’ children to behave in antisocial ways (Patterson, 1984). However, prediction from both children’s conduct problems at the first time-point to sibling relationship quality at the second time-point demonstrates the bidirectional nature of the associations. Although sibling interactions are not simply a reflection of each child’s behaviors, these individual characteristics clearly influence the dyadic relationship.

It was also notable that for both models, the cross-sectional associations at the first time-point were more substantial than at the second time-point. At the first time-point the younger siblings were age four, and the older siblings up to age 9 years. At this time, siblings are still spending large amounts of time with one another (Dunn, 2002), such that there is plenty of opportunity for mutual influence, and much of the individual children’s behavior ratings will be based on the child’s actions while in the company of the sibling. Three years later the younger siblings will be well established in school, and time spent with siblings will have declined as time spent with peers increases (Dunn, 2002); we propose that this shift in everyday activities explains the waning of associations over time.

Older Sibling Dominance

For prosocial behavior, by the second time-point, cross-sectional associations indicate that older sibling behavior is more strongly reflected in sibling positivity than is younger sibling behavior. In addition, older sibling prosocial behavior at Time 1

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predicted sibling dyad positivity *and* younger sibling prosocial behavior at Time 2; younger sibling prosocial behavior had no such influence. Although a similar pattern of findings emerged for conduct problems, differences between older and younger sibling paths were not significantly different in this case.

Overall, we suggest that these results demonstrate that the older siblings within these dyads were more dominant; thus their own behaviors, and particularly their prosocial proclivities, are reflected in the quality of the sibling relationship to a greater degree than the behaviors of the younger children. This suggestion of older sibling dominance is foreshadowed by research findings employing cross-lagged models of analyses indicating that younger siblings are more influenced by their older siblings' behavior and adjustment than vice versa (e.g., Hetherington, Henderson, & Reiss, 1999). This influential role of the older sibling begins at the birth of the younger child (see Dunn & Kendrick, 1982); older siblings' behavior toward the newborn predicts the younger child's behavior within the sibling relationship years later. While evidence does indicate that sibling relationships become more egalitarian over the course of development (see Dunn, 2002), the current findings suggest that the children in our sample (ages 4–12 years) had not yet reached this stage.

Limitations and Future Directions

Theoretically, the current study is consistent with a family systems perspective, as children within families are not interchangeable. In addition, the use of cross-lagged analysis is particularly useful in disentangling complex patterns of family influence. However, in order to reduce heterogeneity, we focussed on the most typical sibling family-type – those families with only two children -- but we acknowledge that these findings may not generalise to families with more than two children. Other limitations include the exclusive use of maternal reports, the low internal reliability of the conduct

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problems measure, and the lack of ethnic diversity. Low internal reliability of the conduct problems measure and lack of ethnic diversity are both factors that would limit reliable variance, thereby serving to depress associations. Sole use of maternal reports, however, may have the effect of inflating the size of associations. Future studies should address these limitations, as well as incorporating additional aspects of the family system. Finally, it is worth noting that these data are now 20 years old. It remains to be seen whether these findings will hold true in the advent of multiple changes, including media and technology.

Implications

Evidence for bidirectionality is good news for clinical applications. It would be consistent to expect that an improvement in *either* sibling relationship quality *or* individual children's behavior could have a positive spillover effect. We also suggest that it may be especially prudent for parents and/or practitioners to focus attention on older siblings' behavior, in particular to bolstering positive behaviors, since these may be likely to cascade downstream to both younger sibling behavior, and to the quality of sibling interaction.

Acknowledgements

We are extremely grateful to all the families who took part in this study, the midwives for their help in recruiting them, and the ALSPAC team, which includes interviewers, computer and laboratory technicians, clerical workers, research scientists, volunteers, managers, receptionists, and nurses. The UK Medical Research Council, the Wellcome Trust (Ref: 102215/2/13/2) and the University of Bristol currently provide core support for ALSPAC.

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Table 1

Correlations Among Study Variables

		1.	2.	3.	4.	5.	6.
Older Sibling							
1.	SDQ Prosocial behavior	.55	-.43	.29	-.10	.32	-.21
2.	SDQ Conduct Problems	-.45	.56	-.08	.25	-.23	.34
Younger Sibling							
3.	SDQ Prosocial behavior	.22	-.10	.46	-.37	.28	-.16
4.	SDQ Conduct Problems	-.14	.23	-.39	.45	-.17	.38
Sibling Dyad							
5.	Relationship Positivity	.37	-.24	.21	-.18	.53	-.13
6.	Relationship Negativity	-.28	.38	-.15	.34	-.19	.59

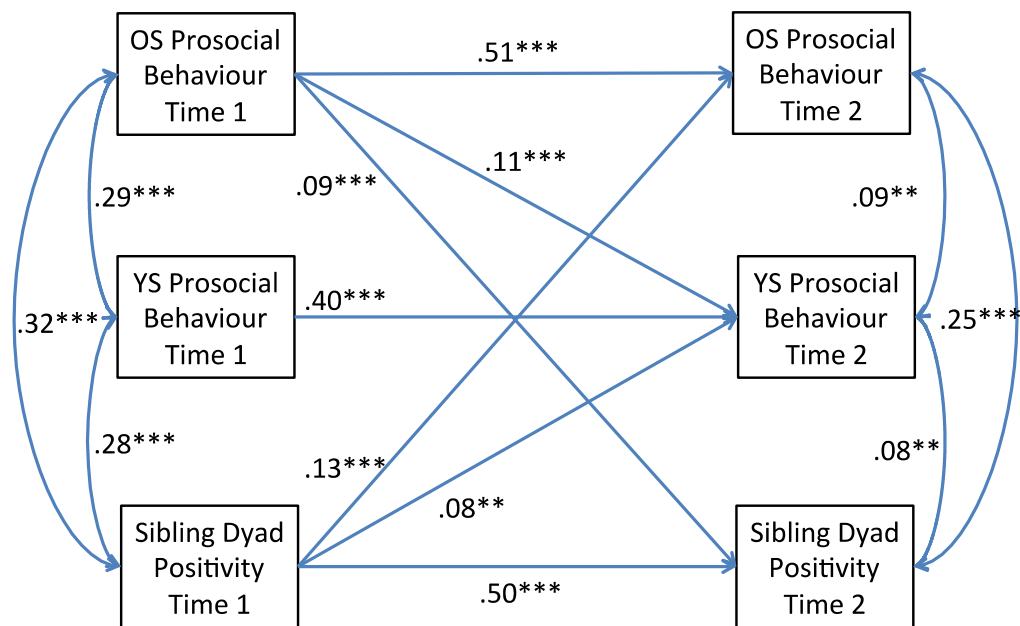
Note. All correlations are significant at $p < .001$.

Stability from Time 1 to Time 2 (correlations between Time 1 and Time 2 measures) is depicted along the diagonal, in bold. Correlations for Time 1 are included above the diagonal, and those for Time 2 below the diagonal.

These correlations use variables that have been standardized for number of boys in the sibling pair, education, and age of older sibling at Time 1.

Figure 1

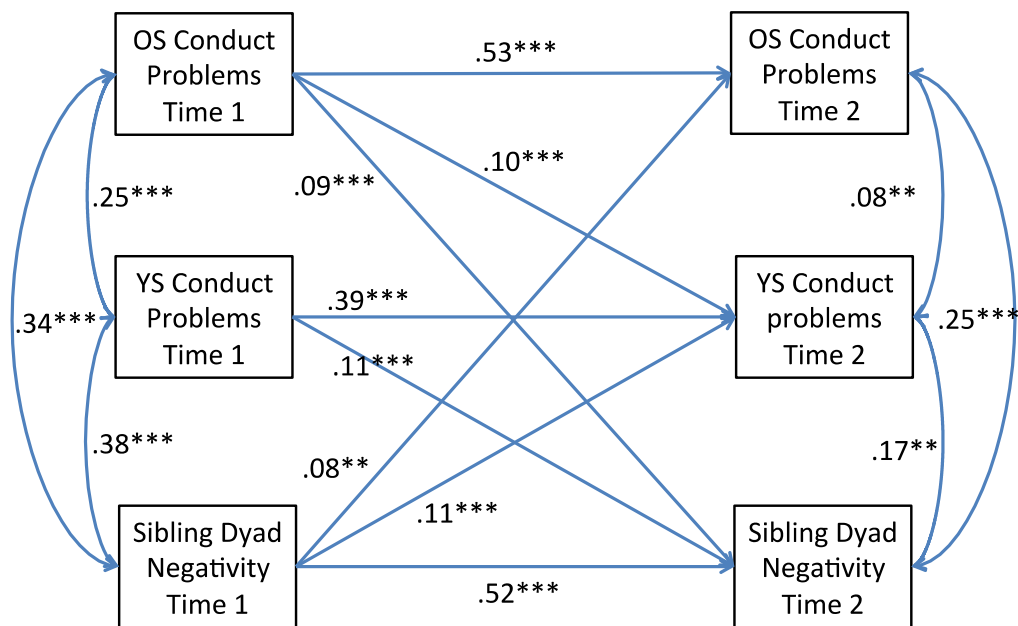
Cross-lagged model of Older (OS) and Younger (YS) Sibling Prosocial Behavior with Sibling Dyad Positivity at Time 1 and Time 2.



*Note: Standardised coefficients are shown for within-time correlations (double-headed arrows) and autoregressive and cross-lagged path coefficients (single-headed arrows); *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.*

Figure 2

Cross-lagged model of Older (OS) and Younger (YS) Sibling Conduct Problems with Sibling Dyad Negativity at Time 1 and Time 2.



*Note: Standardised coefficients are shown for within-time correlations (double-headed arrows) and autoregressive and cross-lagged path coefficients (single-headed arrows); *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.*